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SOVIET 1950 CONFERENCE ON ASTROSPECTROSCOPY

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A conference on astrospectroscopy was held at the Crimean Astronomical Observatory, Academy of Sciences USSR in Simeiz. About 60 persons, representing 22 physical and astronomical institutions, participated in the conference, at which 23 reports were heard.

Academician G. A. Shayn, director of the observatory, opened the conference with a brief talk on one of the founders of contemporary astrophysics, the Russian astronomer Belopolskiy.

The main reports were devoted to stellar and solar physics, the structure of stellar systems, and the nature of interstellar matter.

Academician G. A. Shayn and V. F. Gaza, Senior Scientific Associate of the Crimean Astrophysical Observatory, in their report "The Ratio of Concentration of Isotopes C^{13}: C^{12} in the Atmosphere of Stars," discussed the results of extensive investigations on the spectra of spectral class N stars and low-temperature stars, the atmospheres of which are extraordinarily rich in carbon. The most important result of the investigation was the establishment of the presence of a relatively great abundance of the heavy isotope of carbon C^{13} in the atmosphere of these stars, surpassing by many times its relative abundance in the earth's crust and in the sun. This result possesses very great cosmogonic significance.

Academician G. A. Shayn's extensive report "Variation of Central Intensive Spectral Lines in Spectra of Stars of Different Spectral Classes" was devoted to the very important problem of absorption lines in stellar spectra. The central intensity of absorption lines is determined by the mechanism governing the formation of lines, and their study can serve as a source of information about the mutual interaction of matter and about the atmosphere of stars.

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Comparisons of the central intensity of lines as observed on spectrograms obtained at Simeiz with the intensity theoretically calculated on the basis of the mechanism of "pure absorption" generally proved to be of high order, although not in absolute quantitative agreement. Deviations of the observed values from those calculated for hot stars indicate, in G. A. Shayn's opinion, the influence of light dispersion by free electrons, especially abundant in atmospheres of white supergiants.

Also connected with stellar spectra was the report of Academician G. A. Shayn and P. F. Shayn, Senior Scientific Associate of the observatory, entitled "Some Remarks on the Laboratory System of Wave Lengths." The pressing problem of modern astrophysics is the establishment of the presence of heavy elements and rare earths in the atmospheres of stars. To successfully detect their spectral lines, however, one must first identify in stellar spectra all weak lines of iron and other elements. It became clear that laboratory tables of wave lengths of spectral lines are not sufficiently complete for this purpose and do not satisfy astrophysicists. Also very important is the study of internal motions in the atmospheres of stars by small differential displacements of lines of various elements, but it is necessary to assume the presence of systematic errors in laboratory wave lengths for different elements of the same order as the displacements sought. For this reason, astrophysicists urgently need to extend and to make more accurate the laboratory tables of wave lengths of spectral lines.

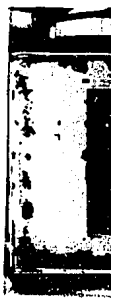
A number of reports were devoted to the study of continuous spectra of stars of various types: Professor E. R. Mustel' (Crimean Astrophysical Observatory) "Energy Distribution in Spectra of New Stars"; Professor B. A. Vorontsov-Vel'yaminov (State Astronomical Institute imeni P. K. Shternberg) "Energy Distribution in Spectra of Stars of the Wolf-Rayet Type"; Senior Scientific Associate V. G. Gorbatskiy (Leningrad State University) "Spectra of Type V Stars"; and Senior Scientific Associate P. P. Dobronravin (Crimean Astrophysical Observatory) "Energy Distribution in Spectra of Some Low-Temperature Stars."

Many statistical investigations connected with the study of the stellar world urgently require a knowledge of absolute values, i.e., actual luminosity of as many stars as possible, and especially of weak ones. The method of determining absolute magnitudes of weak stars by means of spectra, obtained with the objective prism, was discussed in the reports of R. A. Barta (Abastuman Astrophysical Observatory) and L. S. Galkin (Crimean Astrophysical Observatory). The approximate evaluation of complete absorption in spectral lines by similar photographs was discussed in the report of N. M. Gol'dberg, Junior Scientific Associate of the Main Astronomical Observatory.

A number of reports touched on problems of solar physics.

Professor V. A. Krat (Main Astronomical Observatory) discussed in his report the results of processing spectrograms which he obtained on a quartz spectograph during the total solar eclipse on 9 July 1945. A spectrum of the sun's corona, chromosphere, and a weak prominence appeared on the negative. A number of interesting conclusions were drawn concerning the structure of the sun's corona, chromosphere, and mechanism of luminosity excitation.

Professors E. R. Mustel and A. B. Severnyy (Crimean Astronomical Observatory) discussed the results of studies of spectra of chromospheric explosions. The spectra of these quickly passing solar phenomena have been little studied up to now, and the nature of the explosions remains puzzling for the time being. In 1948, the spectrohelioscope of the Crimean Astrophysical Observatory was augmented with two photochambers, permitting one simultaneously to observe visually and to photograph detailed solar spectra by rays of



hydrogen and ionized calcium. The lectures presented many very interesting spectrograms, some of which had already been processed. They showed that the appearance of chromospheric explosions on the sun is accompanied by changes in the contours of spectral lines, which indicate the ionization of gases in the rotating layer of the sun by ultraviolet radiations coming from the flashes underneath.

I. S. Shklovskiy, Senior Scientific Associate of the Crimean Astrophysical Observatory, discussed in his report the radiation of the sun's corona in the far ultraviolet region.

Professors A. B. Severnov and A. B. Gil'varg (Institute of Crystallography, Academy of Sciences USSR), in their report "Interferential Polarization Light Filters for Solar Investigations," described the construction of light filters and results of work with them. The interferential polarization light filter is an apparatus of quartz disks, of strictly definite thickness, interlaid with polaroid films. Such a light filter can be made transparent only for a very narrow band of the spectrum, the width of all the filters being several angstroms. At present only four or five such light filters in the world are applied to solar observations.

Severnov and Gil'varg described the three filters which they constructed. One has a passband 1.8 angstroms wide centered on the red hydrogen line. With this filter, mounted in the optical scheme of a Lyot-type coronograph, one can successfully observe solar prominences and chromosphere. The device is connected to a motion-picture camera, which thus affords continuous photographs of solar phenomena. Some of the photographs have been made into the first Soviet film showing the movement of solar prominences speeded up 700-1,000 times. Motion pictures of the movement of nodes in prominences were also shown, thus affording a very interesting way to investigate changes in radiation and other details. Already some new and important laws and regularities have been found.

The second light filter possesses a passband about 3 angstroms wide and is designed for observations in six chosen wave lengths. The light filter is of high optical quality.

The third interferential polarization light filter is designed for observing the sun by infrared radiation, and already has been successfully applied to solar observations.

Professor A. B. Severnyy and G. A. Monin, Senior Scientific Associate of Crimean Astrophysical Observatory, in their report "Spectroheliograph of the Crimean Astrophysical Observatory," described an apparatus, developed by them and constructed in the workshop of the observatory, which allows one to obtain good spectroheliograms by rays of hydrogen and ionized calcium.

In a short report entitled "Test of Interferential Spectrophotometry of Fraunhofer Lines," Professor A. B. Severnyy discussed studies, conducted at Simeiz, on the contours of solar spectral lines by photographs obtained by means of spectrographs and a Fabri-Pero calibrating device.

V. B. Nikonov, Senior Scientific Associate of the Crimean Astrophysical Observatory, reported on the electrospectrophotometer constructed in the observatory. This is an apparatus for automatically recording the solar spectrum with the aid of photomultipliers. This apparatus permits one to study the solar spectrum directly, thus avoiding photographic photometry.

The results of studies of luminous diffusive nebulas were discussed by Academician G. A. Shayn and V. F. Gaza, Senior Scientific Associate in the observatory, in their report "Investigations of Luminous Nebulas at the Crimean

Astrophysical Observatory." With the aid of two powerful mirror photochambers (diameter 450 mm, light power 1:1.4) having glass and interferential light filters that pass a narrow band of the spectrum, they obtained photographs of nebulas by the radiation of the red line of hydrogen and of the continuous spectrum near the line but external to it. This permits one to distinguish gaseous nebulas that radiate only linear spectra and dark nebulas that have continuous spectra. The photographs obtained already give enough data for a number of important conclusions to be made. (See Vestnik Akademii Nauk SSSR, No 5 and 6, 1950, pp 94, 95 and 36-38.)

V. B. Nikonov, V. I. Krasov (Crimean Astrophysical Observatory), and A. A. Kalinyak (Main Astronomical Observatory) discussed results of photographing the galactic center with the aid of electronic-optic converters in rays with wave length of about one micron. The study of central parts of the galaxy, i.e., of our sidereal system, and the so-called galactic nucleus is very important for understanding the structure of the system as a whole. But in the direction toward the galactic center lies a thick cloud of interstellar material, opaque to photographic and visual rays. Dark interstellar material, however, is more transparent to long-wave radiation, which gives hope for its considerable penetration by invisible infrared radiation. On the photographs obtained in 1948 - 1949 was discovered a large stellar cloud similar to the familiar cloud in the constellation Sagittarius, invisible on ordinary photographs. Obviously, the newly discovered stellar cloud together with the cloud in Sagittarius are portions of the galactic nucleus, the center of which is covered with still greater dark clouds of interstellar material, opaque also to rays of this wave length. Taking the distance to the galactic nucleus as 25,000 light years, one can evaluate its dimensions as approximately 5,000 light years.

V. I. Krasov, in his report "The Nature of Radiation of the Night Sky," attempted to interpret the nature of bright lines in the infrared radiation of the nocturnal sky (to 11,000 A), first discovered by the reporter. In his opinion, they result from the forbidden transition between the levels $^1\Delta - 3\Sigma$ of molecular oxygen. I. S. Shklovskiy, commenting on the report, pointed out the possibility of still another interpretation of this radiation, namely, as radiation occurring during rotational-vibrational transitions of the hydrogyl molecule (OH).

I. S. Shklovskiy, in his report "Monochromatic Radio Radiation of the Galaxy and the Possibility of Observing It," discussed a new branch of astrophysics, namely, radio astrospectroscopy. According to his calculations, short-wave radio radiation of interstellar gas can be observed.

Z. L. Morgenshtern, Senior Scientific Associate of the Physical Institute imeni P. N. Lebedev, in his report "The Application of Scintillant Phosphors for Photographing Infrared Radiation," discussed a new and interesting photographic method which is beginning to find application also in astrophysics.

Also heard were: V. A. Al'bitskiy, Senior Scientific Associate of the Crimean Astrophysical Observatory, "Project of the Stellar Spectrograph of the Crimean Astrophysical Observatory"; and Professor B. A. Vorontsov-Vel'yaminov, "Spectrum of 1942 Comet Tevzadze 2."

The conference adopted a resolution which noted the necessity of still closer cooperation between astrophysicists and physicists, and suggested certain forms of this cooperation.

The participants of the conference made excursions into the Bakhchisaraya region, where they inspected the new construction going on at the Crimean Astrophysical Observatory.

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